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ABSTRACT

A total of 50 college students enrolled in different sections of a language arts methodology course served as treatment and control groups to investigate the effects of student-generated questions on test performance. Periodically throughout the course, students in the treatment group received instruction in effective questioning techniques by discussing and evaluating hypothetical test questions produced by the professor and participating in a reciprocal questioning strategy, known as "ReQuest," designed to help students think as they read. Treatment group students were also required to compose two multiple-choice and two true-false questions for the 12 chapters in the course textbook. Three tests and a comprehensive final examination served as the independent measures. The results of analysis of covariance and the Johnson-Neyman Technique indicate that the treatment condition was effective only for students with higher levels of prior knowledge related to language arts methodology upon entry into the course, and that it was detrimental to students who had lower levels of prior knowledge, as reflected in the pretest scores. (TJH)

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THE EFFECTS OF STUDENT-GENERATED QUESTIONS ON TEST PERFORMANCE

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Abstract

College students enrolled in different sections of a language arts methodology course served as treatment and control groups to investigate the effects of student-generated questions on test performance. Three tests and a comprehensive final exam served as the dependent measures. Results of ANCOVA and the Johnson-Neyman Technique indicated that the treatment condition was effective ($p < .05$) only for students with higher levels of prior knowledge related to language arts methodology upon entry into the course, and it was detrimental to students who had lower levels of prior knowledge, as reflected by pretest scores.

EFFECTS OF STUDENT-GENERATED QUESTIONS ON TEST PERFORMANCE

Introduction

The value of using adjunct questions to enhance student comprehension of text and to encourage the development of thinking skills has been reported (Durkin, 1981; Graves & Clark, 1981; Redfield & Rousseau, 1981; Reynolds & Anderson, 1980; Tierney & Cunningham, 1980). However, several variables related to questioning need further study, such as: the amount and type of questioning, the identification of learning situations in which questioning is of most benefit, and the significance of the source (i.e., text, teacher, or student) of questioning.

There is some evidence that students gain more from text when they generate their own questions as opposed to responding to teacher-produced questions (Anderson & Armbruster, 1980; Andre & Anderson, 1978-79). Devine (1986) believes that having students prepare an actual test after reading can help them determine main points, relevant information, and the writer's purpose. But, other researchers (Herber & Nelson, 1975; Rumelhart, 1980, 1984) are concerned that students usually lack effective questioning skills and may not have acquired sufficient schemata for the topic/concept being studied to permit higher

levels of questioning to occur.

It may be that student-generated questions which are too general in nature, as well as questions which emphasize insignificant details, may be detrimental to the growth of thinking skills. The purpose of this study was to examine the effects of student-generated questions on the test performance of college students majoring in elementary education.

Methodology

Subjects. A total of 50 students, who were classified as juniors, were involved in the study which lasted for one semester. The treatment group contained 26 students, and the control group contained 24 students. No significant differences were found between the two groups in either their mean ACT scores ($t(46) = 0.82$, ns) or their mean GPAs ($t(46) = 1.36$, ns). GPAs and ACT scores were not available for two of the students. Mean ACT and GPA scores for the treatment and control groups were 15.72 (ACT_e), 2.90 (GPA_e), 16.48 (ACT_c), and 3.15 (GPA_c). The two groups of students were enrolled in different sections of a language arts methods course, both of which were taught by the first author.

Procedures. At the beginning of the course, both classes were given a 25-item pretest, containing 15 multiple-choice and 10 true-false items, covering major language arts concepts. The pretest items assessed only the knowledge category of Bloom's (1956) taxonomy. During the course, both groups were

given three tests (each covering four chapters) and a comprehensive final exam. The same tests were used with both groups, and all tests contained multiple-choice and true-false items composed by the professor. Each of the four tests contained items representing each of the six major categories (i.e., knowledge, comprehension, application, analysis, synthesis, and evaluation) identified by Bloom (1956).

Periodically throughout the course, the treatment group received instruction in effective questioning techniques by (1) discussing and evaluating hypothetical test questions produced by the professor, and (2) participating in a reciprocal questioning strategy, known as ReQuest (Manzo, 1969), which is designed to help students think as they read. ReQuest encourages students to generate their own questions about the content material under study. The strategy requires both teacher and students to take turns asking each other questions about a portion of text material they have read. During the procedure, the teacher's role as a good questioner serves as a model that students begin to emulate in the formation of their questions. Also, the students were required to compose four test questions (2 multiple-choice and 2 true-false) for each of 12 chapters in the text, after the chapter had been discussed in class. The test questions were collected every two weeks by the professor who encouraged the students to write questions requiring more than literal recall. As an incentive to get

students to think about the text material, the professor told the students that those questions which represented levels of cognitive processing beyond the knowledge level might be considered for inclusion on the final exam. However, none of the tests contained specific items written by the students.

The students in the control group were encouraged to ask questions during class discussions about the content of each chapter of the text. During lectures the professor posed questions, representing the six major categories of Bloom's (1956) taxonomy, to facilitate discussion of major concepts contained in each chapter and to check students' understanding of the text material.

Data Analysis. The three tests administered during the course and the final exam served as the dependent variables, referred to as Tests 1, 2, 3, and 4, respectively. Failure to meet the assumption of homogeneity of regression precluded the use of ANCOVA for three of the four dependent measures. For these three measures, (i.e., Tests 1, 3, and 4) the Johnson-Neyman Technique (see Kerlinger & Pedhazur, 1973) was used to determine pretest score regions in which the two groups differed.

Results

Tests of the assumption of homogeneity of regression resulted in the rejection of equal regression slopes for Test 1 ($p < .04$), Test 3 ($p < .01$), and Test 4 ($p < .03$). Homogeneity

of regression was accepted only for Test 2. Correlations between the pretest scores and scores on each of the four tests are presented in Table 1. The pretest scores were not found to be significantly related to scores on any of the four dependent variables for the control group; however, the pretest scores were signficantly and positively related to scores on each of the four variables for the treatment group.

Insert Table 1 about here

Analysis of covariance for the Test 2 scores, using the pretest as the covariate, indicated no significant differences in the adjusted means for the treatment and control groups. The adjusted means for the treatment and control groups were 79.22 and 75.69, respectively.

Since scores on Tests 1, 3, and 4 did not meet the assumption of homogeneity of regression, the Johnson-Neyman technique was used to analyze scores on these tests. The Johnson-Neyman technique defines regions along a predictor variable dimension where significant differences exist between two regression lines. However, prior to this analysis, the pretest score means were compared using a t-test. No significant pretest score differences were found between the two groups ($t(48) = 0.18$, ns).

Application of the Johnson-Neyman technique to the

treatment and control group regression lines for the Test 1 scores indicated that the performance of the treatment and control groups differed significantly only for those students scoring below 46.8% on the pretest. Examination of the plots of the pretest-Test 1 regression lines for the two groups (Figure 1), indicates higher performance on Test 1 for students in the control group. In other words, student-generated questions had a detrimental effect on Test 1 scores for those students scoring below 46.8% on the pretest with no differences in performance for those scoring above 46.8%.

Insert Figure 1 about here

Analysis of the Test 3 scores using the Johnson-Neyman technique resulted in two regions of significance. The treatment and control group students were found to differ in their Test 3 performance when their pretest scores were less than 42.6% and when their pretest performance was greater than 58.4%. Examination of the pretest-Test 3 regression lines for the two groups indicates that when pretest performance was greater than 58.4%, the treatment group outperformed the control group on Test 3; however, when pretest performance was less than 42.6%, the control group outperformed the treatment group.

The results of application of the Johnson-Neyman technique

to the Test 4 scores yielded results similar to those found with Test 3. The regions of significance were for pretest scores below 42.3% and for pretest scores above 70.8%. When pretest performance exceeded 70.8%, the treatment students outperformed the control group students, however, when pretest performance was less than 42.3%, the control students outperformed the treatment group students.

Discussion

In general, for the control group there was no relationship between pretest performance and performance on each of the dependent variables. However, for the treatment group there were significant, positive relationships between the pretest and each of the dependent variables. The pattern of performance on each of the four dependent variables was basically the same: treatment-group students scoring high on the pretest outperformed corresponding students in the control group, and conversely, control-group students scoring low on the pretest outperformed corresponding students in the treatment group.

Do student-generated questions improve test scores of students? The general finding was that the treatment condition had a positive effect on students with higher levels of prior knowledge related to language arts methodology upon entry into the course and a negative effect on students with lower levels of prior knowledge. The finding that student-generated questions

had a detrimental effect on test performance of students with lower levels of prior knowledge was surprising, although it offers some support for the concerns expressed by other researchers (Herber and Nelson, 1975; Rumelhart, 1980, 1984) related to the need for sufficient schemata as a prerequisite for effective questioning. This finding conflicts somewhat with that of Andre and Anderson (1978-79) who found that student generation of questions during study was more effective for lower than for higher verbal ability students. Although verbal ability and prior experience are not synonomous, both are related to comprehension performance. Therefore, one wonders if the performance of the students in the Andre and Anderson (1978-79) experiments would have remained stable had the study involved more than one testing session.

Based on the findings of Brown and Smiley (1978), the investigators of this study had anticipated that requiring students to generate questions would encourage them to spend more time in direct interaction with text material, hence improving their test performance. Although students in the treatment group stated that composing the required questions took a lot of time, it doesn't appear that the increase in study time was of equal benefit to students with higher and lower levels of prior knowledge related to the content of the course.

One could argue that the results of Tests 3 and 4 indicate

that higher levels of prior knowledge combined with the cumulative effects of student-generated questions have significant, positive affects on test performance. However, student-generated questions in combination with higher levels of prior knowledge do not appear to produce immediate positive effects.

The results of this study support the general conclusion that student-generated questions may not benefit students who are just beginning to develop schemata related to language arts methodology, but for those students whose schemata is better developed in the area of language arts the process may be quite beneficial. This conclusion is in agreement with ideas related to prior knowledge which have been expressed by Bransford (1979) and other cognitive psychologists (cf Ausubel, 1963, 1968; Buhler, 1908). In the words of Bransford (1979), "simply having prior knowledge when making comprehension ratings or recalling is not necessarily sufficient to ensure adequate results. Previous knowledge must be activated in order to facilitate one's current abilities to understand and learn" (p. 135). Whether or not the learner's prior knowledge becomes activated seems to depend on one or more of the following variables: the extent of prior knowledge as well as the conditions under which the knowledge was acquired; the sequential nature of learning; the role of practice in the acquisition and mastery of new concepts and skills; the

conditions that facilitate transfer of knowledge to new examples; and the degree to which certain types of experiences help students learn to learn.

It is possible that students in the treatment group who had lower levels of prior knowledge upon entry into the course needed to acquire a better understanding of basic language arts concepts prior to generating questions. It may be that students with lower levels of prior knowledge should not be required to generate questions about text material until they reach a specified level of proficiency in the categories of knowledge and comprehension. Requiring these students to compose questions about the text material may have caused them to concentrate on details rather than main ideas and practical application of concepts. Also, it could be that the time these students spent composing questions could have been better used by them in practice activities related to the acquisition and mastery of new concepts.

While prior knowledge seems to facilitate learning in general, the findings of this study suggest that future studies should explore the degree to which certain types of learning activities help students learn to learn and the conditions that facilitate transfer of knowledge to new examples. Also, further research is needed to (a) identify the specific types of learning experiences which complement varying levels of prior knowledge, and (b) determine whether or not student-generated questions

have a cumulative effect on test performance.

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Table 1

Correlations Between Pretest Scores and Scores on Tests 1-4 For the Treatment and Control Groups

Test	Control	Treatment
1	.003	.537**
2	.129	.519**
3	-.227	.441*
4	.019	.541**

* $p < .05$

** $p < .01$

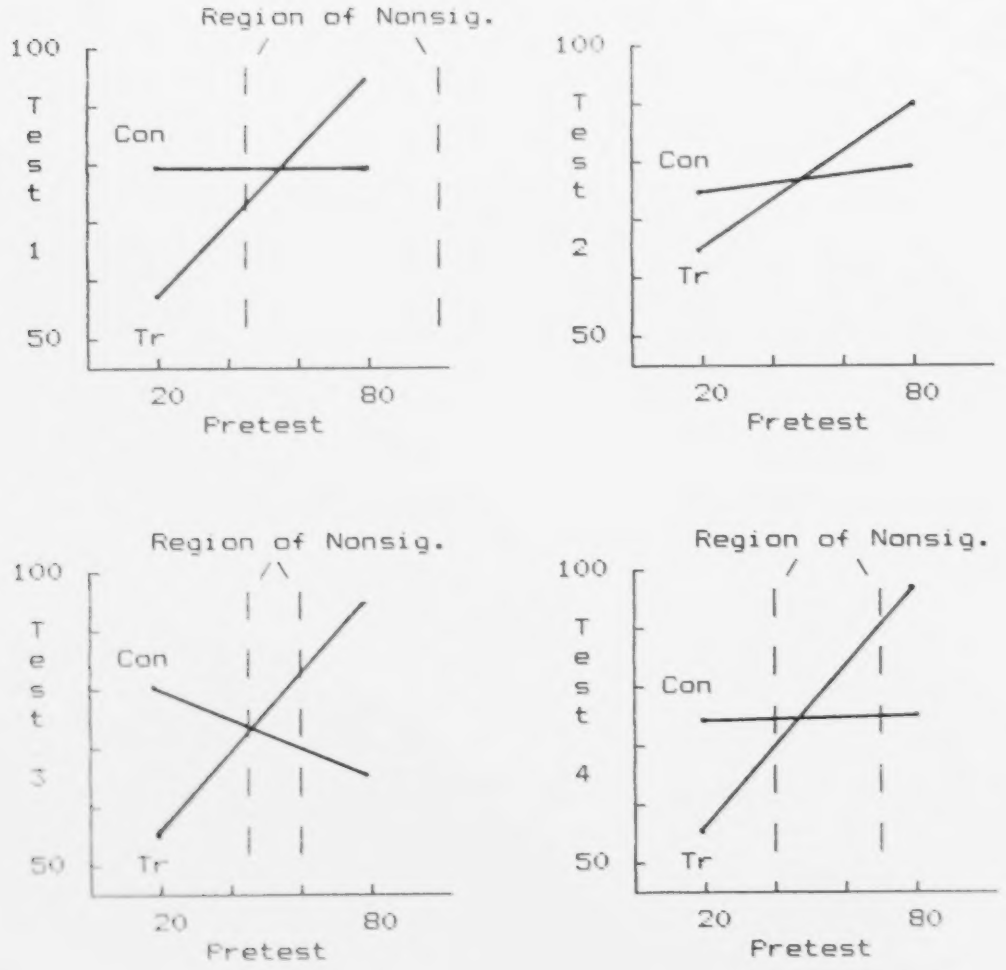

Figure 1. Regions of nonsignificance for each variable.